TEST REPORT

Test Report No. : UL-RPT-RP-15478060-116B

Applicant:	Braun GmbH
Model Number:	3796
FCC ID:	USQ3796
Test Standard(s):	Antenna Gain Measurement (Derived rom FCC Part 15.247(b)(3))

1. This test report shall not be reproduced in full or partial, without the written approval of UL International Germany GmbH.
2. The results in this report apply only to the sample tested.
3. Test Report Version 1.1 supersede Version 1.0 with immediate effect
   Test Report No. UL-RPT-RP-15478060-116B Version 1.1, Issue Date 14 November 2024 replaces Test Report No. UL-RPT-RP-15478060-116B Version 1.0, Issue Date 11 November 2024, which is no longer valid.

Prepared by: Yixiang Li
Title: Project Engineer
Date: 14 November 2024

Approved by: Muhammad Faiq, Khan
Title: Project Engineer
Date: 14 November 2024

Deutsche Akkreditierungsstelle D-PL-19381-02-00

This laboratory is accredited by DAkkS.
The tests reported herein have been performed in accordance with its' terms of accreditation.

UL INTERNATIONAL GERMANY GMBH
Hedelfinger Str. 61
70327 Stuttgart, Germany
STU.CTECHLab@ul.com

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1. Customer Information

1.1.Applicant Information

Company Name:	Braun GmbH
Company Address:	Frankfurter Straße 145, 61476 Kronberg/Taunus Germany
Contact Person:	Aida Ayoubzadeh
Contact E-Mail Address:	Ayoubzadeh.a.4@pg.com
Contact Phone No.:	+496173305403

1.2.Manufacturer Information

Company Name:	Braun GmbH
Company Address:	Frankfurter Straße 145, 61476 Kronberg/Taunus Germany
Contact Person:	Aida Ayoubzadeh
Contact E-Mail Address:	Ayoubzadeh.a.4@pg.com
Contact Phone No.:	+496173305403

2. Summary of Testing

2.1. General Information

Applied Standards

Specification Reference:	47CFR15.247
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) – Sections 15.247

Location

Location of Testing:	UL International Germany GmbH Hedelfinger Str. 61 70327 Stuttgart Germany
Test Firm Registration:	399704

Date information

Order Date:	04 January 2024
EUT arrived:	06 February 2024
Test Dates:	12 March 2024 to 22 October 2024
EUT returned:	-/-

2.2. Summary of Test Results

Clause	Measurement
Part 15.247(b)(3) / ANSI C63.10 Annex G	Antenna Gain Masurement

Results:

Frequency (MHz)	Condcuted Output Power (dBm)	Max. EIRP (dBm)	Antenna Gain (dBi)
2402	-0.85	-2.28	-1.43
2440	-1.17	-1.75	-0.58
2480	-1.24	-1.49	-0.25

Notes:

1. Antenna Gain in dBi was calculated in accordance with ANSI C63.10 G.3:

$$\text{ERP/EIRP} = P_T + G_T - L_C$$

Rearranged:

$$G_T = \text{ERP/EIRP} - P_T + L_C$$

L_C is ignored since there is no cable connected between transmitter and antenna.

2. The calculated Antenna Gain is in dBi, since the correction factors used in the measurement of Radiated ouput power were also calculated by considering the Antenna dBi values.

2.3. Methods and Procedures

Reference:	ANSI C63.10-2013
Title:	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
Reference:	KDB 558074 D01 DTS Meas Guidance v05r02 April 2, 2019
Title:	Guidance for compliance measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under Section 15.247 of the FCC rules

2.4. Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Brand Name:	BRAUN
Model Name:	3796
Test Sample Serial Number:	eM7-0742 (Radiated Test Sample)
Hardware Version Number:	3796
Firmware Version Number:	N/A
FCC ID:	USQ3796

Brand Name:	BRAUN
Model Name :	3796
Test Sample Serial Number:	eM7-0542 (RF Conducted Test Sample)
Hardware Version Number:	3796
Firmware Version Number:	N/A
FCC ID:	USQ3796

3.2. Description of EUT

The equipment under test was a Wireless Toothbrush, Model: 3795, supporting Bluetooth LE technology.

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing

Technology Tested:	Bluetooth Low Energy		
Type of Radio Device:	Transceiver		
Power Supply Requirement(s):	Nominal	3.6 V DC Li-Ion Battery Powered	
Tested Data rate:	1 Mbps		
Nominal Channel Bandwidth:	1 MHz		
Antenna Type:	Inverted F antenna		
Antenna Details:	Integral Antenna		
Transmit Frequency Range:	2402 MHz to 2480 MHz		
Transmit Channels Tested:	**Channel ID**	**Channel Number**	**Frequency (MHz)**
	Bottom	37	2402
	Middle	17	2440
	Top	39	2480

3.5. Description of Available Antenna

The radio utilizes an Integrated, inverted F antenna with maximum measured gain stated below.
The measured conducted peak output power was subtracted from the measured radiated peak EIRP to obtain the antenna gain in dBi.

Antenna Details	Antenna Type	Frequency (MHz)	Antenna Gain (dBi)
Integral Antenna	Inverted F Antenna	2402	-1.43
		2440	-0.58
		2480	-0.25

3.6. Support Equipment

The following support equipment was used to exercise the EUT during testing:

A. Support Equipment (In-house)

Item	Description	Brand Name	Model Name or Number	Serial Number
1	-/-	-/-	-/-	-/-

B. Support Equipment (Manufacturer supplied)

Item	Description	Brand Name	Model Name or Number	Serial Number
1	-/-	-/-	-/-	-/-

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

The EUT was tested in the following operating mode(s):
☒ Transmitter / Modulated Carrier Continuous Transmissions Mode Bluetooth Low Energy, • BTLE: 1 Mbps | Bottom / Middle / Top Channel | MAX PWR

4.2. Configuration and Peripherals

The EUT was tested in the following configuration(s):

EUT Power Supply:

- The EUT was powered by internal 3.6V DC Li-Ion Battery.

Test Mode Activation:

- The EUT was prepared by customer to Transmit continuously on the different channels when powered on. The channels can be switched using the button on the EUT.

Conducted Measurements:

- All conducted measurements were carried out by using the EUT RF sample with SMA connector. The RF port on the EUT was connected to the spectrum analyser using suitable attenuation and RF cable. The measured values takes into consideration the external attenuation correction factors.The RF cable attenuation maximum 0.9 dB@2.4GHz from the EUT to Analyzer.

Radiated Measurements:

- All radiated measurements were carried out by using the EUT Radiated sample.
- The EUT with its Integral antenna is positioned on xy, yz, xz planes, and measuring radiated power at specific steps with the vertical and Horizontal antenna polarisation placed at 1.5m.
- The EUT and Antenna both were placed at a fixed height of 1.5m from the ground plane, the turn table was rotated 360° in 5° steps and the worst-case emissions at every axis of EUT and Antenna polarisation was rmeasured and recorded.

5. Measurements, Examinations and Derived Results

5.1. General Comments

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to Section 6 *Measurement Uncertainty* for details.

In accordance with DAkkS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

5.2. Test Results

5.2.1. Transmitter Maximum (Peak) Output Power

Test Summary:

Test Engineer:	Abbas Al-Hussainy	Test Date:	12 March 2024
Test Sample Serial Number:	eM7-0542 (RF Conducted Test Sample)		
Test Site Identification	SR 9		

FCC Reference:	Part 15.247(b)(3)
Test Method Used:	FCC KDB 558074 Section 8.3.1.1 referencing ANSI C63.10 Sections 11.9.1.1

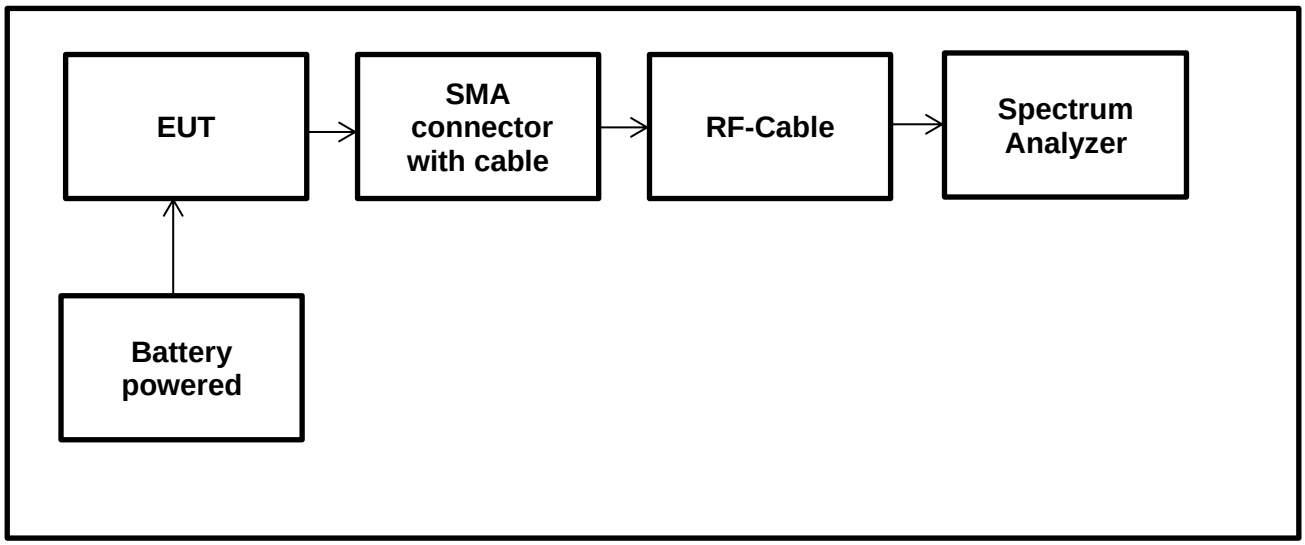
Environmental Conditions:

Temperature (°C):	24.2
Relative Humidity (%):	37.4

Notes:

1. Final measurements were performed using the below configurations on the bottom, middle and top channels.
2. •BTLE: 1 Mbps | Bottom / Middle / Top Channel | MAX PWR
3. The EUT was transmitting at 100% duty cycle and testing was performed in accordance with ANSI C63.10 Section 11.9.1.1.
4. The RF port on the EUT was connected to the spectrum analyser using suitable attenuation and RF cable. The measured values takes into consideration the external attenuation correction factors.The RF cable attenuation maximum 0.9 dB@2.4GHz from the EUT to Analyzer
5. Therefore, total a reference level offset 0.9 dB was added to each of the at the tested frequencies conducted plots.

Test Setup:

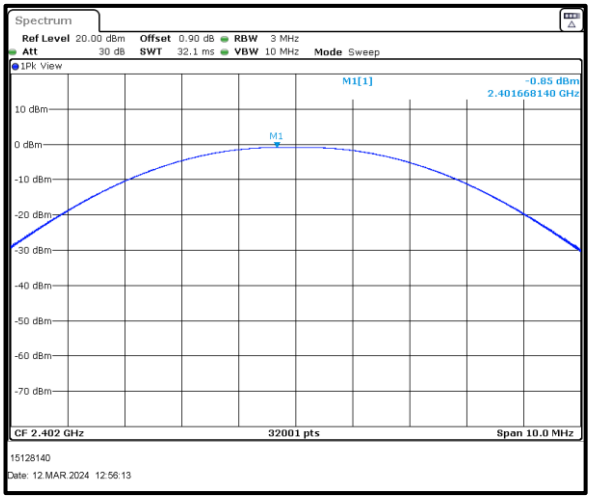


Transmitter Maximum (Peak) Output Power (continued)

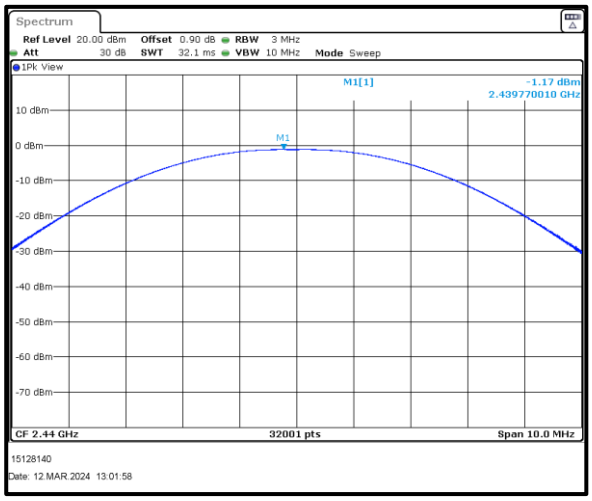
Results :

Channel	Conducted Peak Power (dBm)
Bottom	-0.85
Middle	-1.17
Top	-1.24

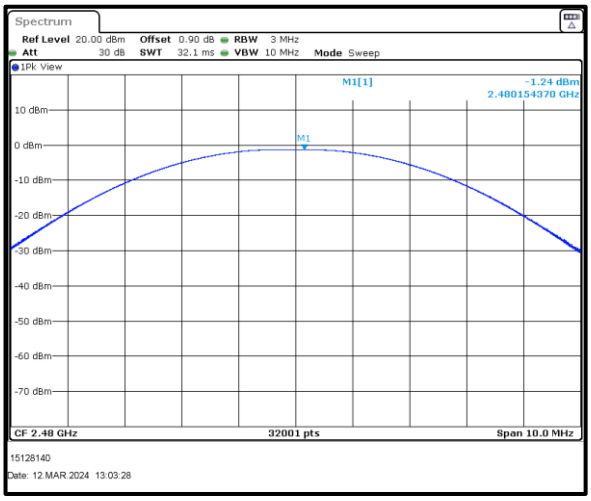
Plots :



Bottom Channel



Middle Channel



Top Channel

5.2.2. Transmitter Radiated Output Power

Test Summary:

Test Engineer:	Abbas Al-Hussainy	Test Date:	22 October 2024
Test Sample Serial Number:	eM7-0742 (RF Radiated Test Sample)		
Test Site Identification	SR 1/2		

FCC Reference:	Part 15.247(b)(3)
Test Method Used:	ANSI C63.10 Annex G

Environmental Conditions:

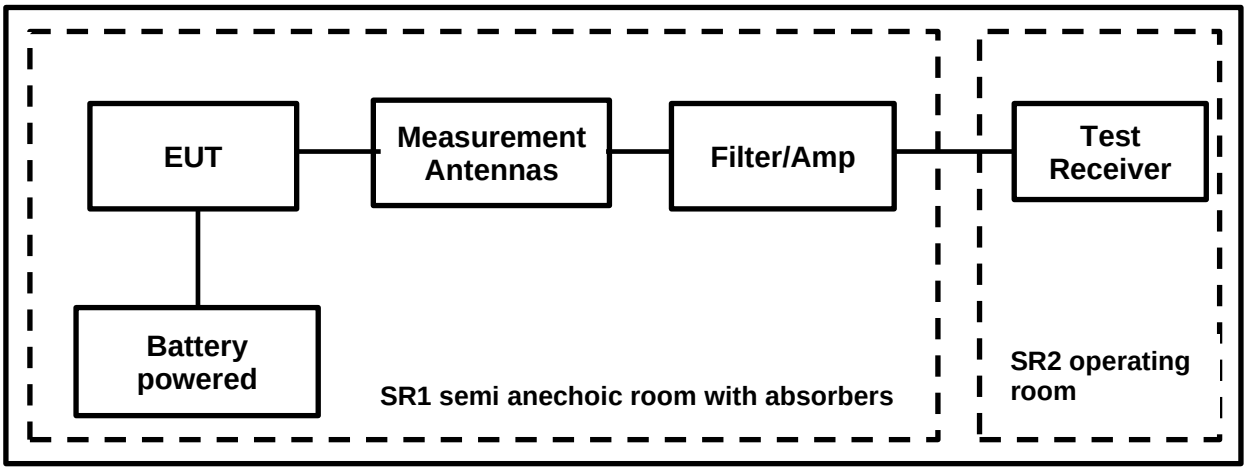
Temperature (°C):	22.1
Relative Humidity (%):	52.3

Notes:

1. The spectrum analyser resolution bandwidth was set to 1 MHz and video bandwidth of 3 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 10 MHz. A marker was placed at the peak of the signal and the results recorded in the table below.

2. The correction factors (offset) used in the measurement of Radiated ouput power were calculated by considering the Antenna dBi values.

Test Setup:



Transmitter Radiated Output Power (continued)

Results :

Frequency (MHz)	Condcuted Output Power (dBm)	Max. EIRP (dBm)	Antenna Polarisation	Calculated Gain (dBi)
Bottom	-0.85	-2.28	Horizontal	-1.43
Middle	-1.17	-1.75	Horizontal	-0.58
Top	-1.24	-1.49	Horizontal	-0.25

Notes:

1. Antenna Gain in dBi was calculated in accordance with ANSI C63.10 G.3:

$$ERP/EIRP = P_T + G_T - L_C$$

Rearranged:

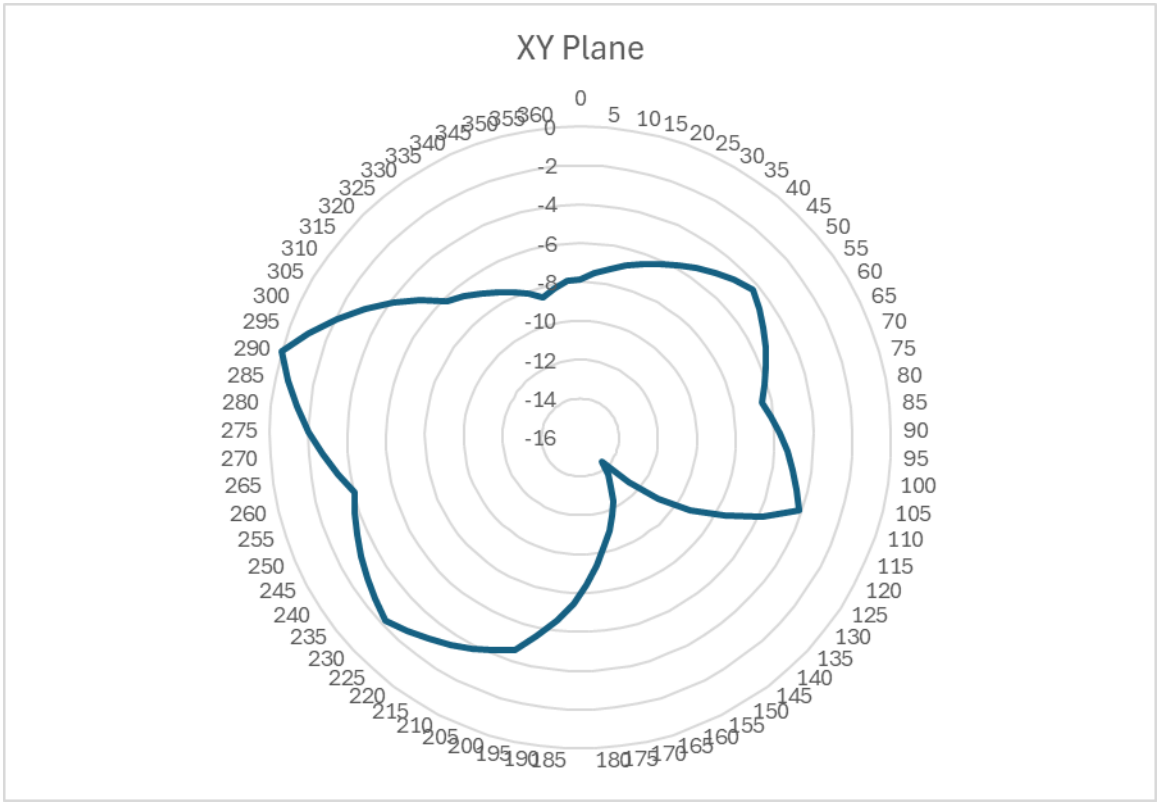
$$G_T = ERP/EIRP - P_T + L_C$$

L_C is ignored since there is no cable connected between transmitter and antenna.

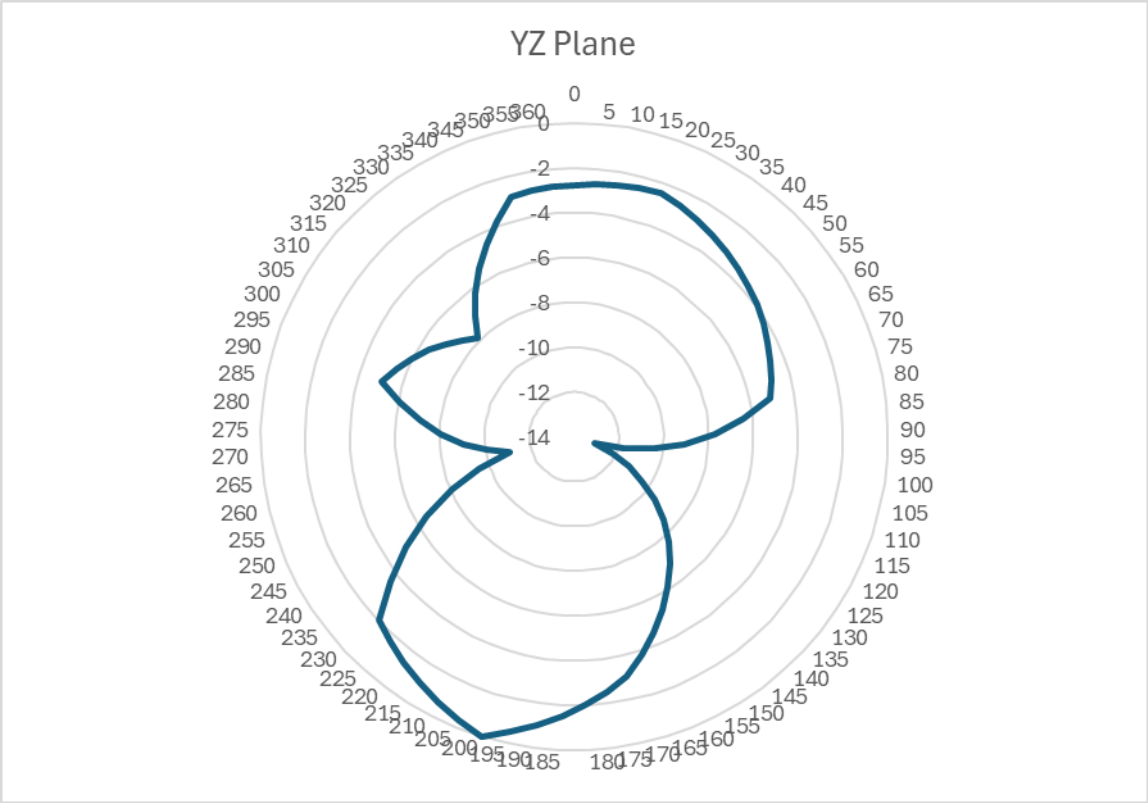
Plots :

Bottom Channel
Vertical

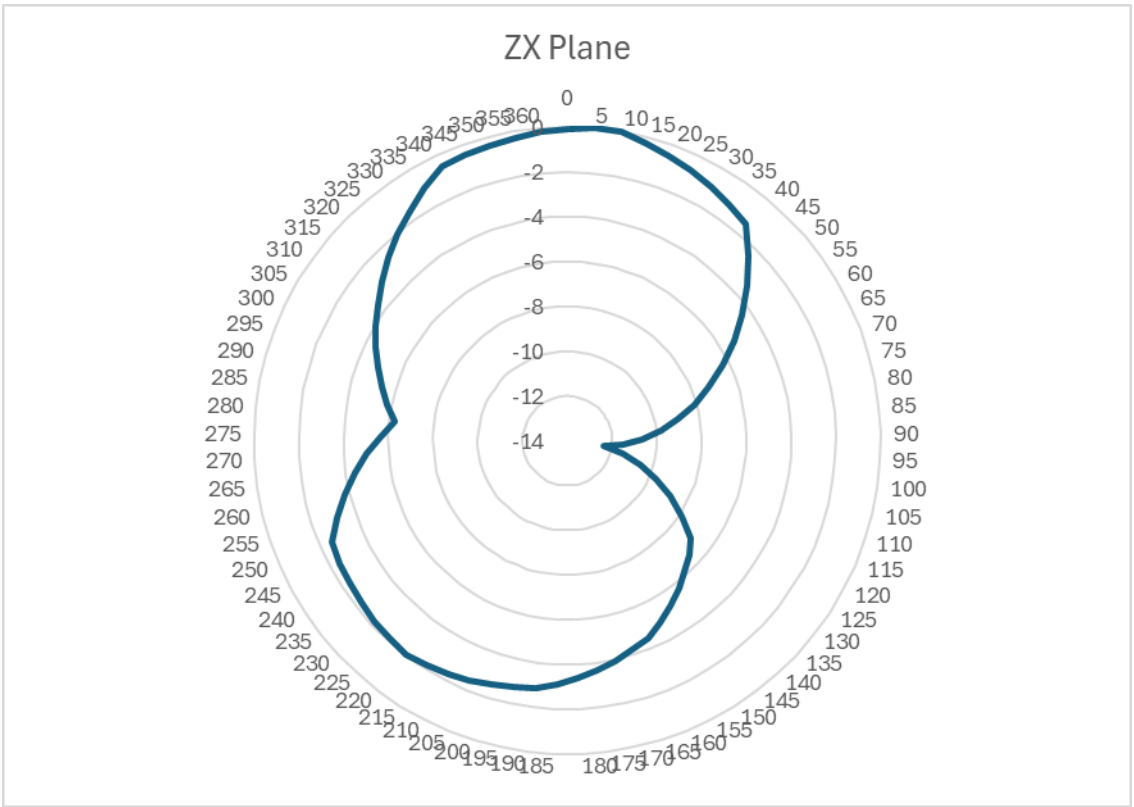
Normalized Antenna Gain Plot



Max gain -2.2 dBi



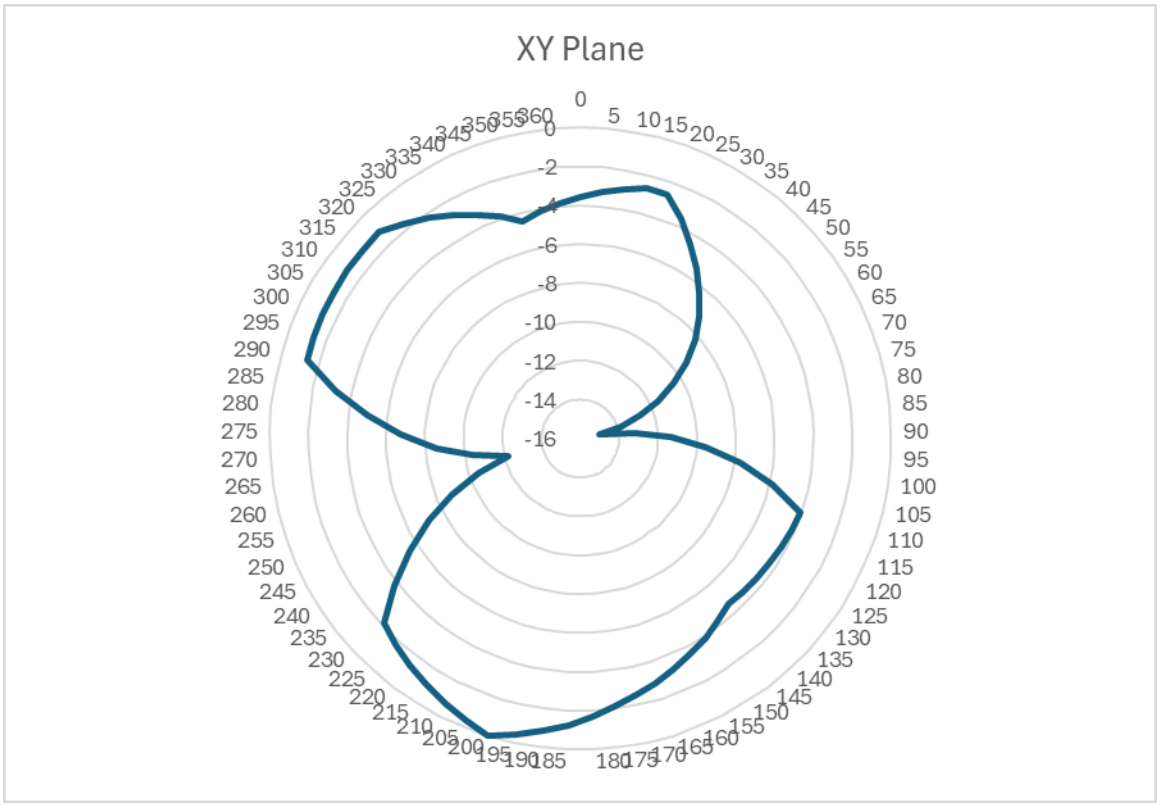
Max gain -8.37 dBi



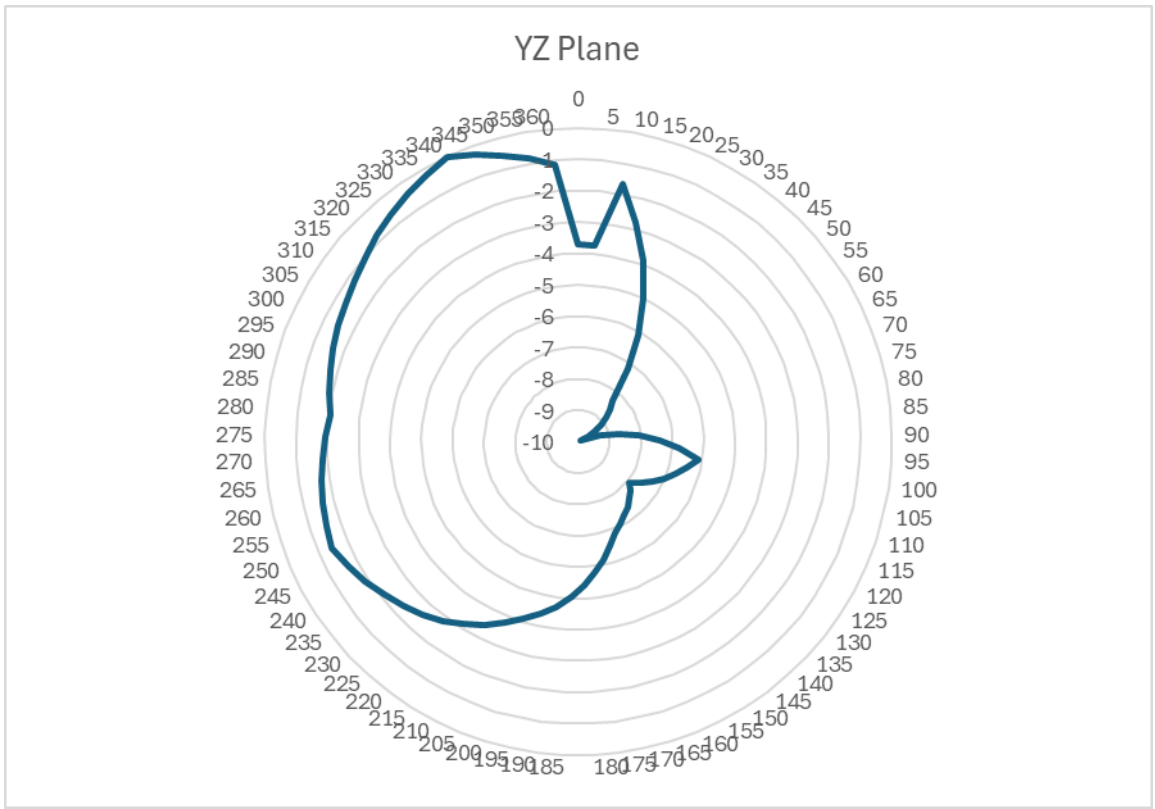
Max gain -3.61 dBi

Bottom Channel
Horizontal

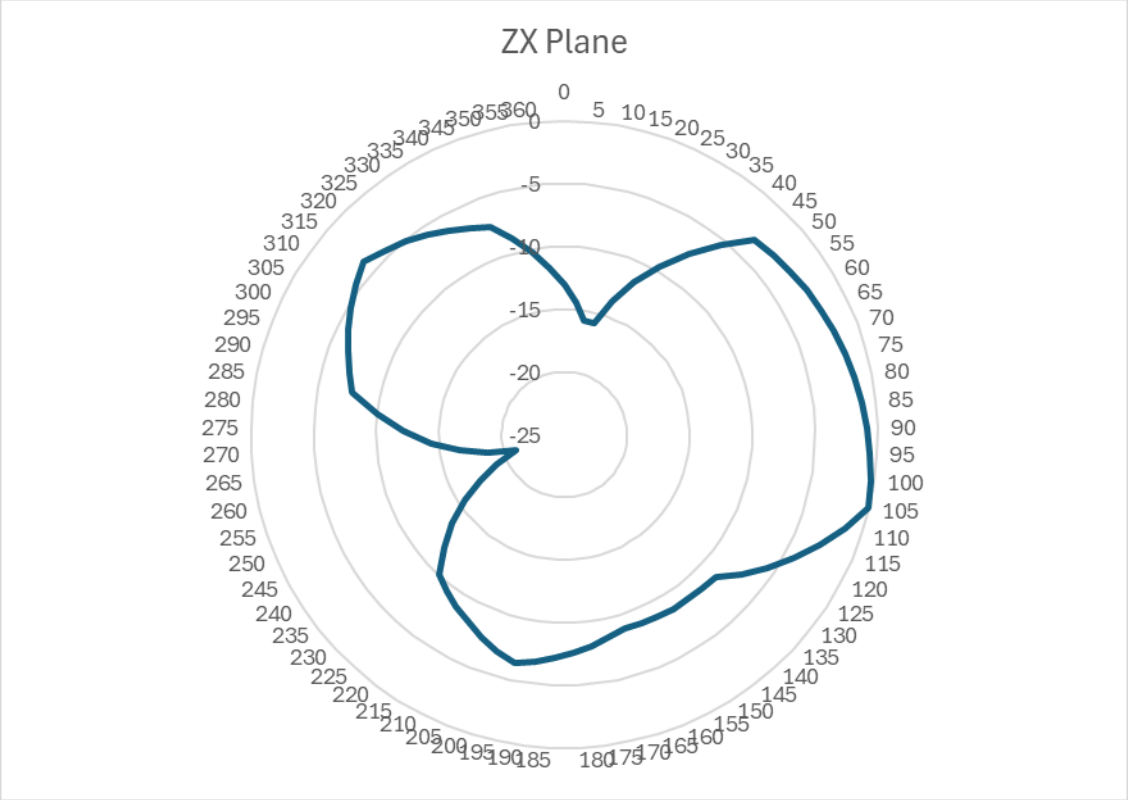
Normalized Antenna Gain Plot



Max gain -12.87 dBi



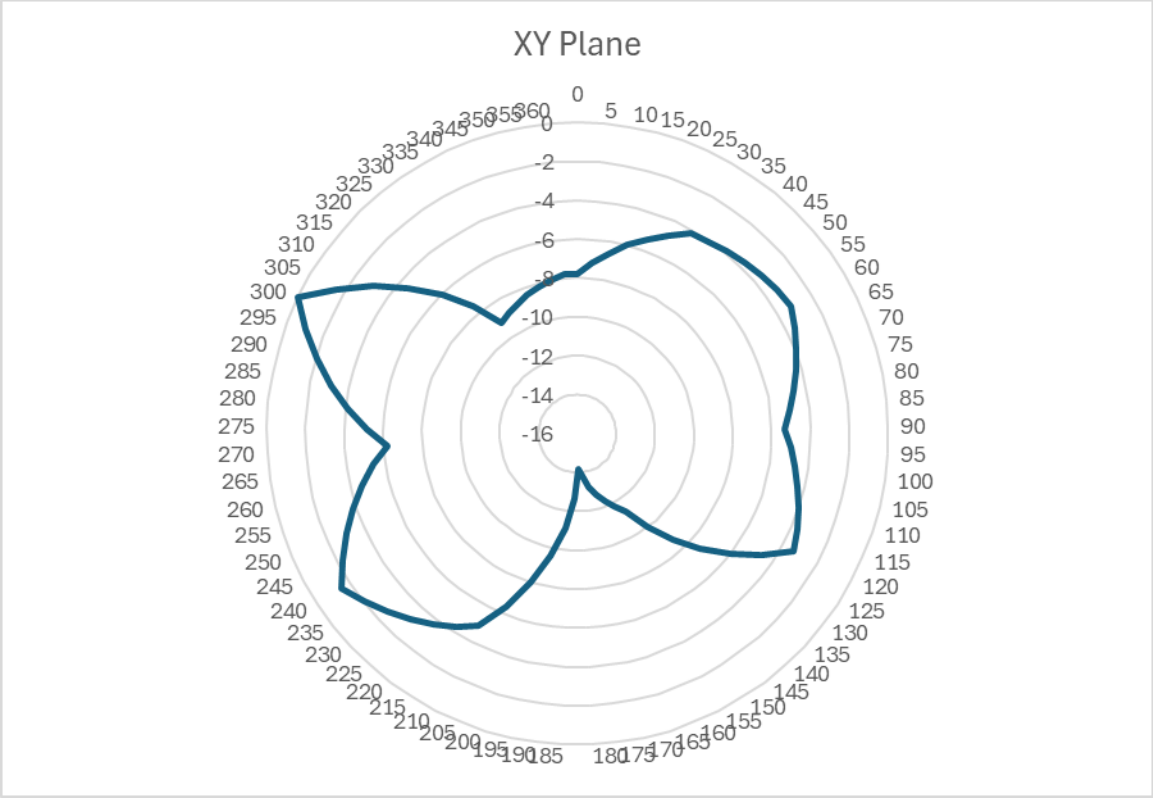
Max gain -1.43 dBi



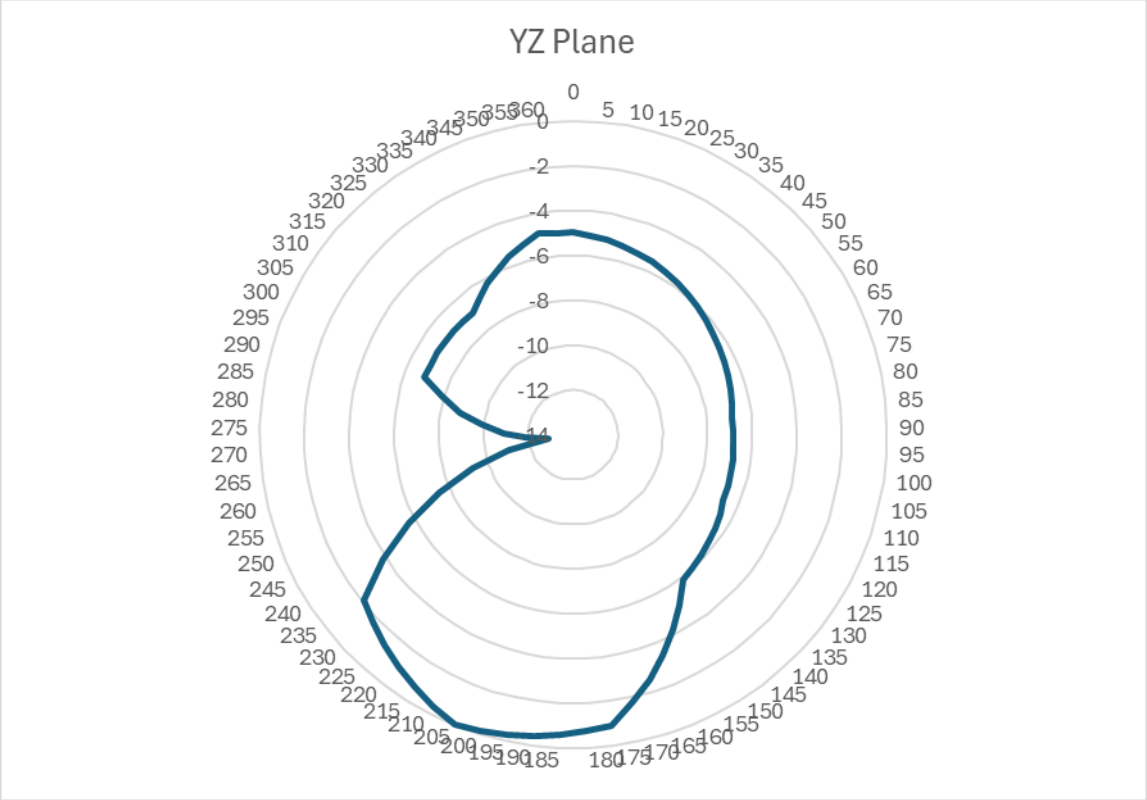
Max gain -3.15 dBi

Middle Channel
Vertical

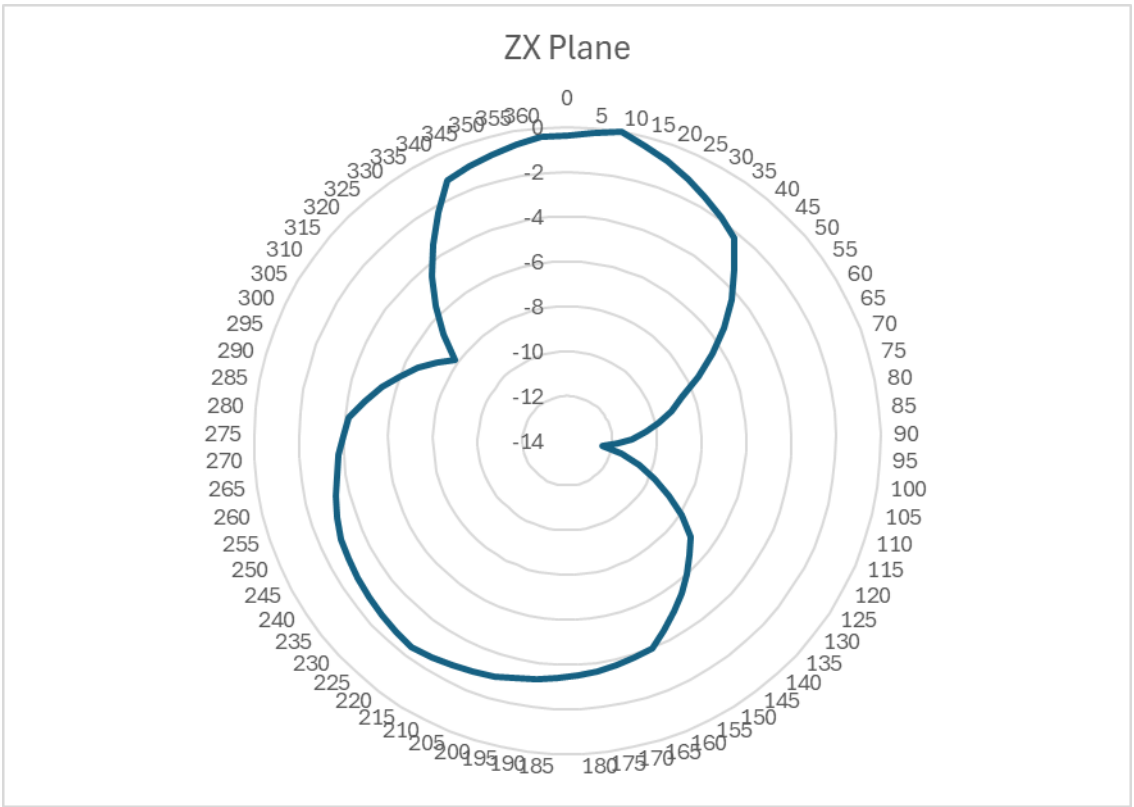
Normalized Antenna Gain Plot



Max gain -2.64 dBi



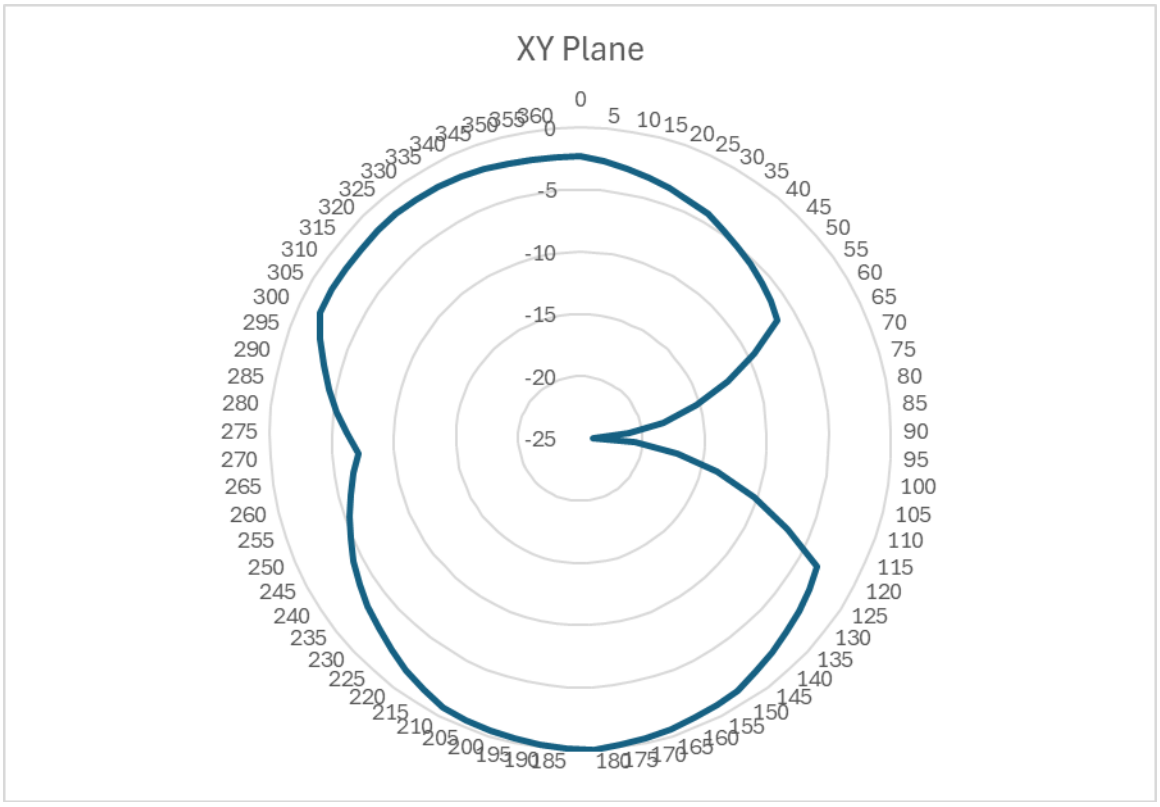
Max gain -8.3 dBi



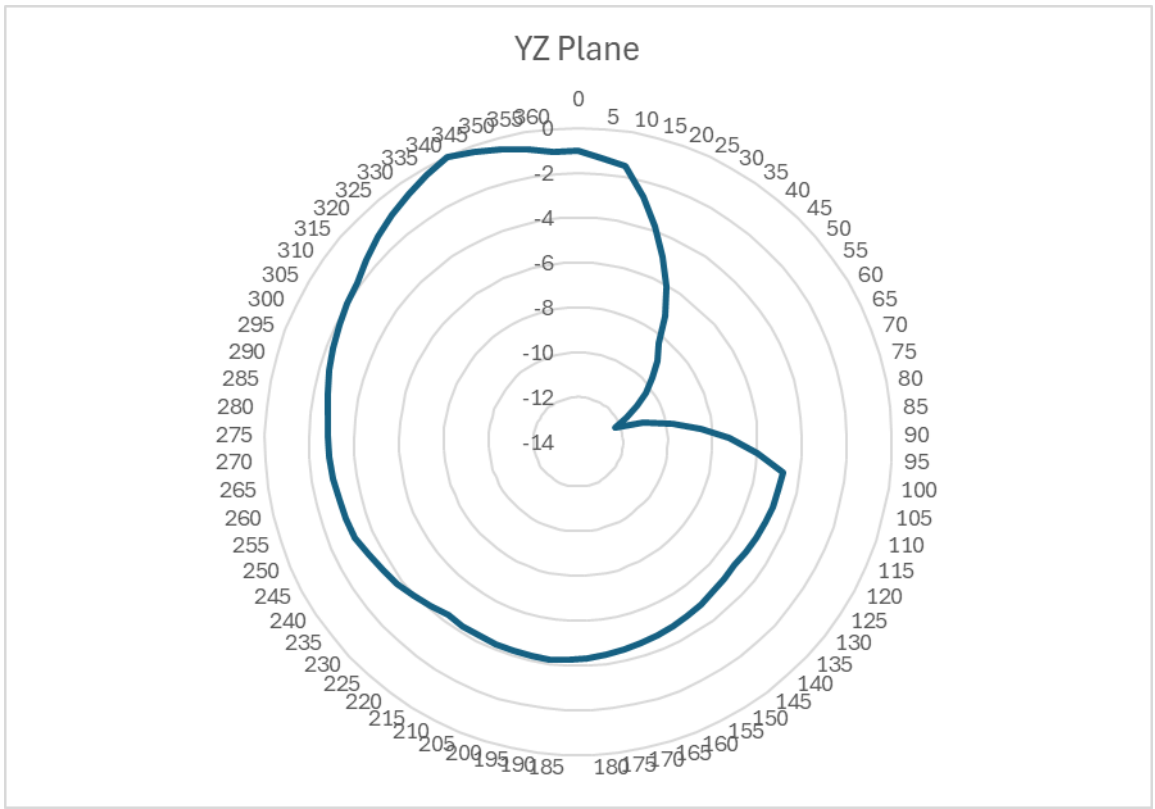
Max gain -2.9 dBi

Middle Channel
Horizontal

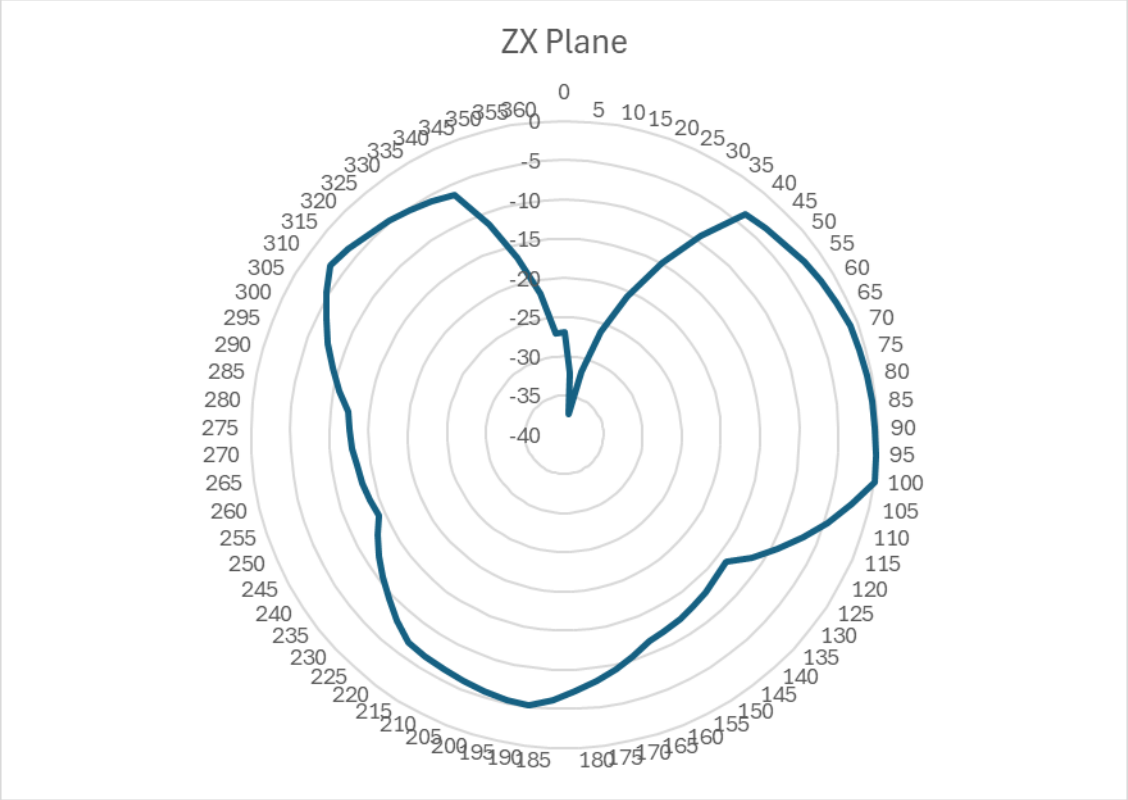
Normalized Antenna Gain Plot



Max gain -11.07 dBi



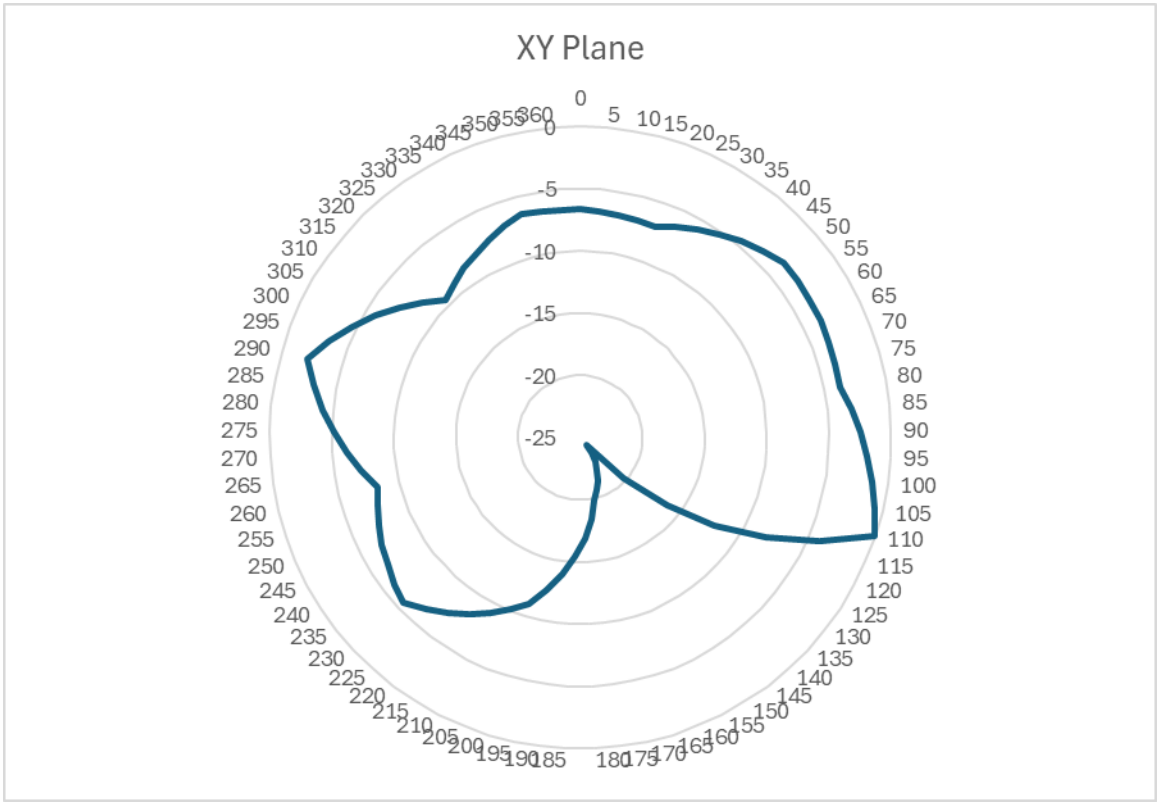
Max gain -0.58 dBi



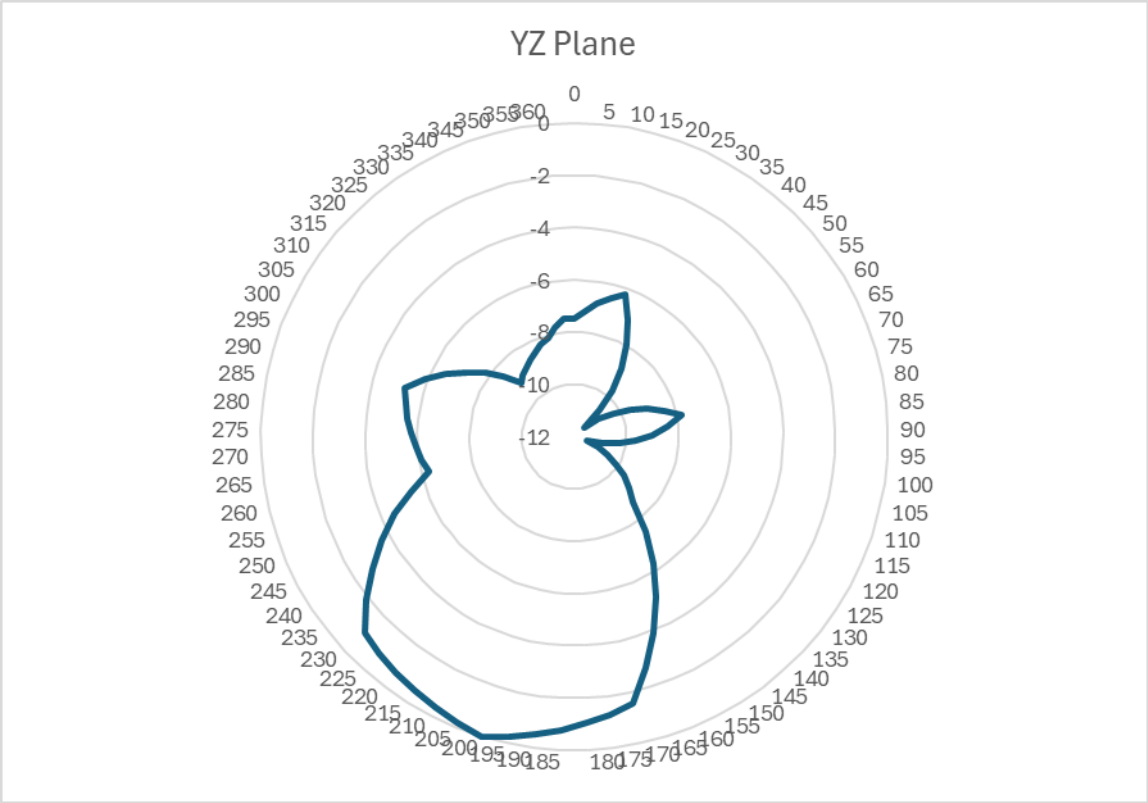
Max gain -3.7 dBi

Top Channel
Vertical

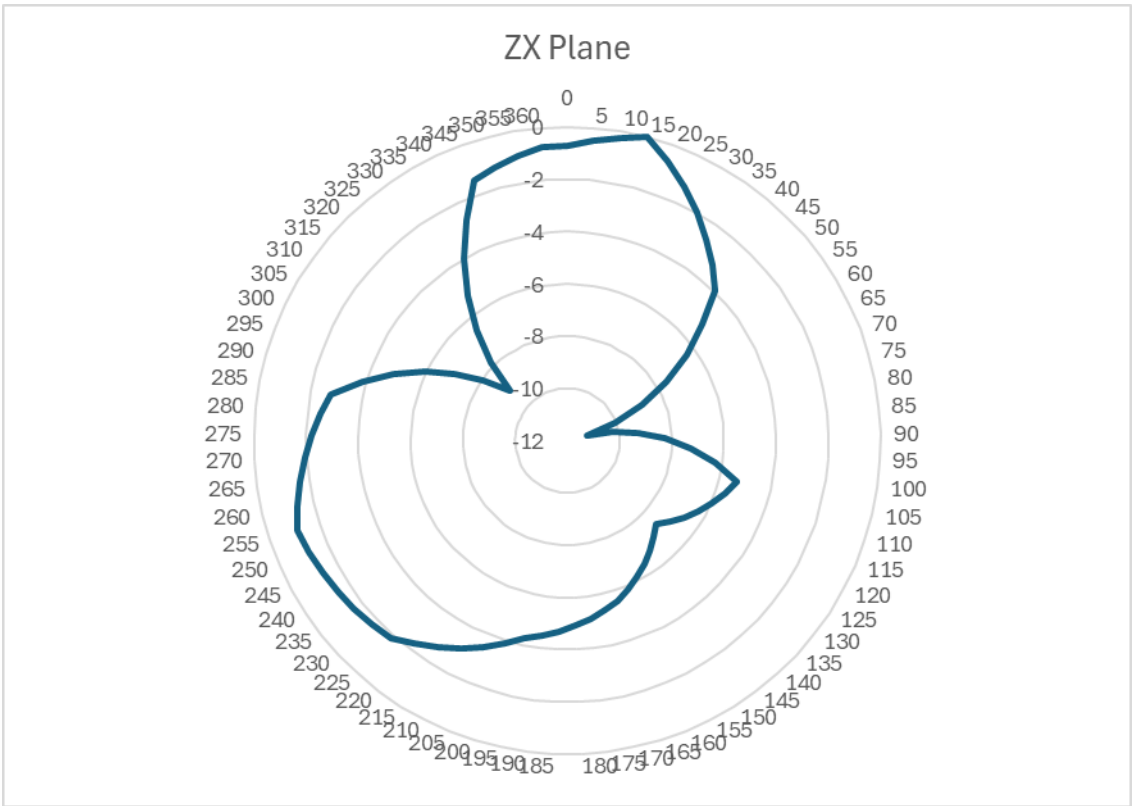
Normalized Antenna Gain Plot



Max gain -3.05 dBi



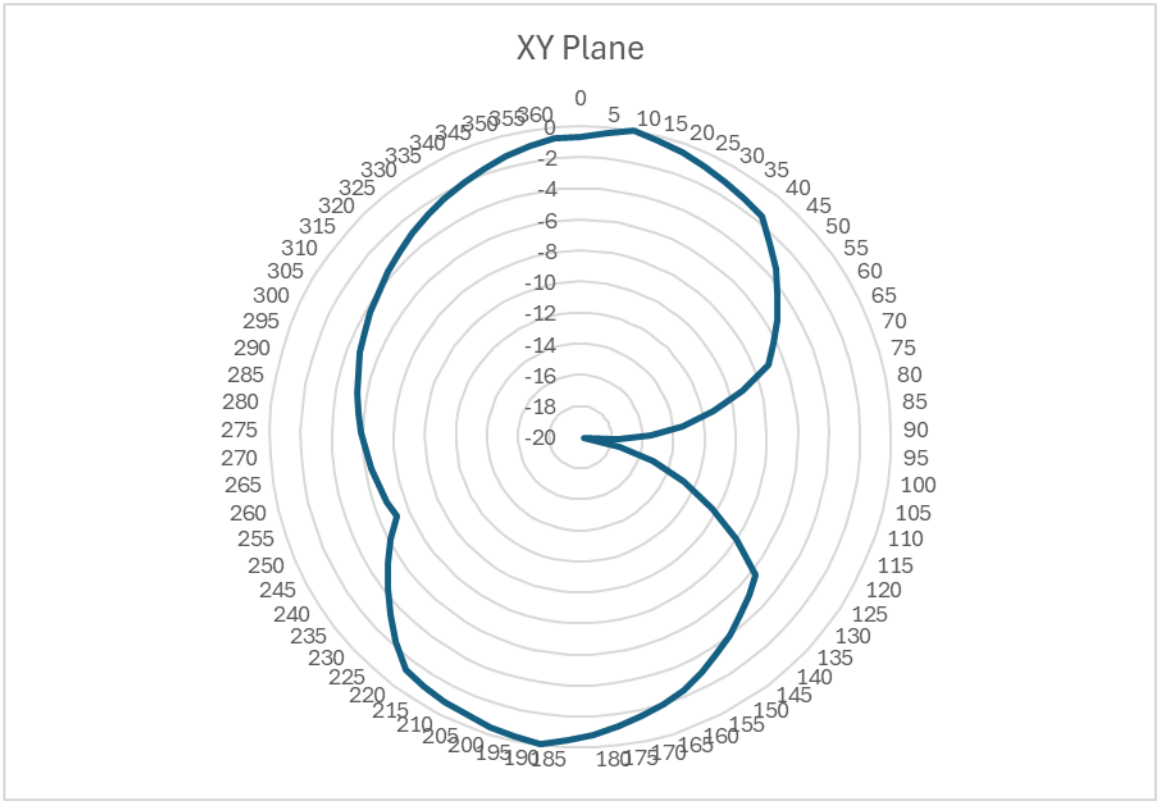
Max gain -8.83 dBi



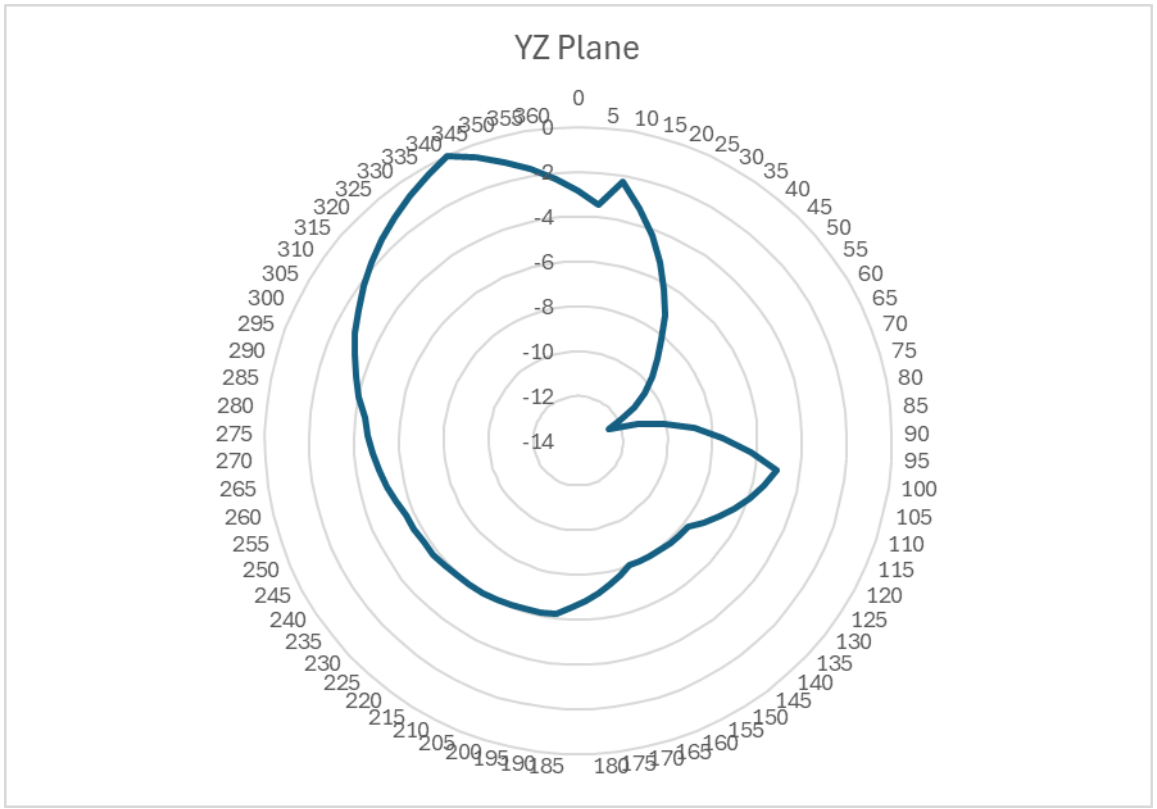
Max gain -4.42 dBi

Horizontal

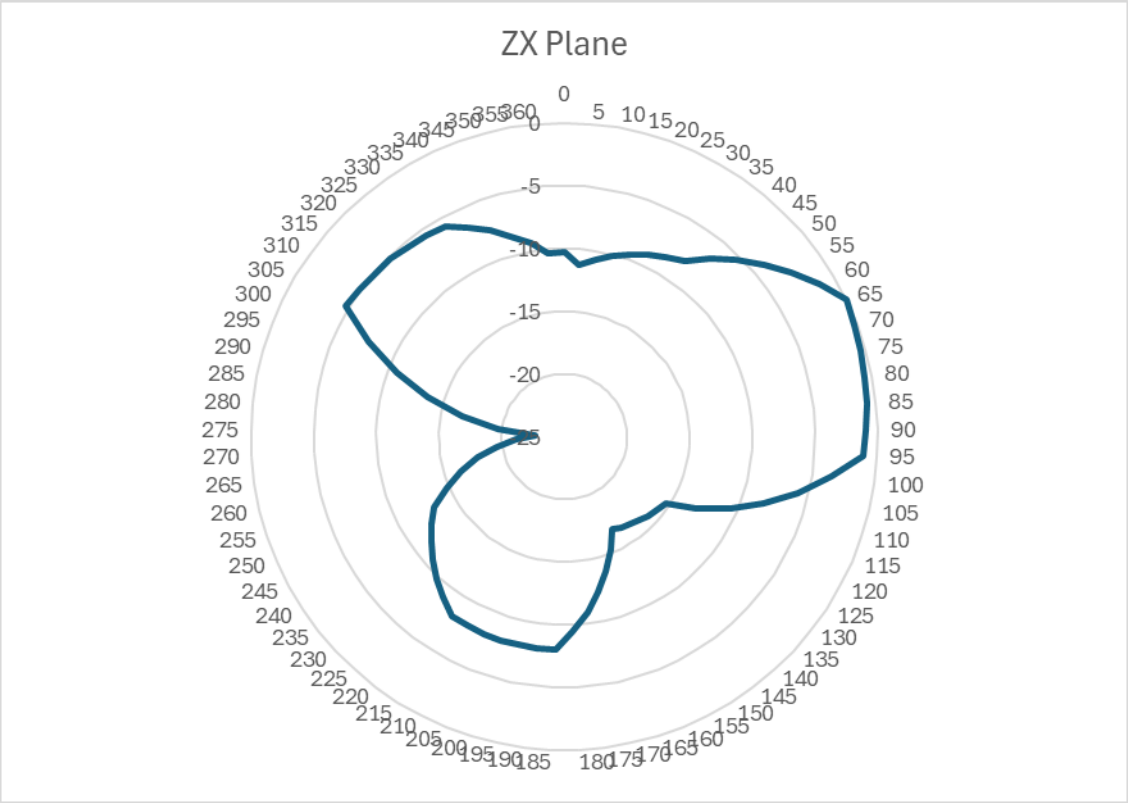
Normalized Antenna Gain Plot



Max gain -10.24 dBi



Max gain -0.25 dBi



Max gain -3.1 dBi

6. Measurement Uncertainty

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Measurement Type	Confidence Level (%)	Calculated Uncertainty
Conducted Maximum Peak Output Power	95%	±0.59 dB
Radiated Spurious Emissions	95%	±3.10 dB

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

7. Used equipment

Test site: SR 1/2

ID	Manufacturer	Type	Model	Serial	Calibration Date	Cal. Cycle (months)
1	Rohde & Schwarz	Antenna, Loop	HFH2-Z2	831247/012	18/07/2023	36
377	BONN Elektronik	Amplifier, Low Noise Pre	BLMA 0118-1A	025294B	18/07/2023	12
460	Deisel	Turntable	DT 4250 S	n/a	n/a	n/a
465	Schwarzbeck	Antenna, Trilog Broadband	VULB 9163	01691	30/11/2023	36
496	Rohde & Schwarz	Antenna, log. - periodical	HL050	100297	22/08/2022	36
588	Maturo	Controller	NCD	029/7180311	n/a	n/a
669	Rohde & Schwarz	EMI Test Receiver	ESW 44	103087	13/07/2023	18
608	Rohde & Schwarz	Switch Matrix	OSP 120	101227	lab verification	n/a
628	Maturo	Antenna mast	CAM 4.0-P	224/19590716	n/a	n/a
629	Maturo	Kippeinrichtung	KE 2.5-R-M	MAT002	n/a	n/a
-/-	Testo	Thermo-Hygrometer	608-H1	01	lab verification	n/a
328	SPS	AC/DC power distribution system	PAS 5000	A2464 00/2 0200	lab verification	n/a
1603665	Siemens Matsushita Components	semi-anechoic chamber SR1/ 2	-/-	B83117-A1421-T161	n/a	n/a
681	Maturo	Antenna mast, tilting	BAM4.5-P	402/0718.1	n/a	n/a

Test site: SR 9

ID	Manufacturer	Type	Model	Serial	Calibration Date	Cal. Cycle (months)
637	Rohde & Schwarz	Spectrum Analyzer	FSV40	101587	12/07/2023	18
-/-	Huber+Suhner	RF Cable -OSP120-DUT1	ST18/SMAm/SMAm/72	605505	lab verification	n/a
-/-	Testo	Thermo-Hygrometer	608-H1	07	lab verification	n/a
1603668	Siemens Matsushita Components	shielded room	--	B83117-B1422-T161	n/a	n/a

8. Internal Photos

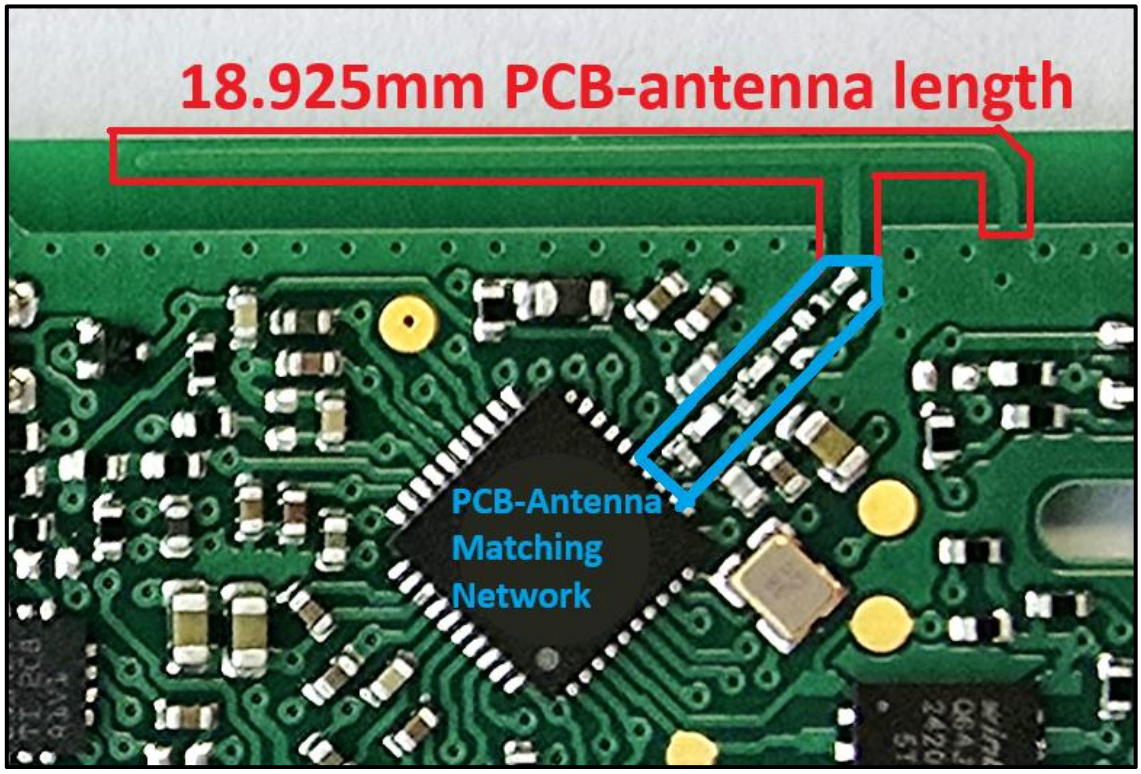


Photo 1

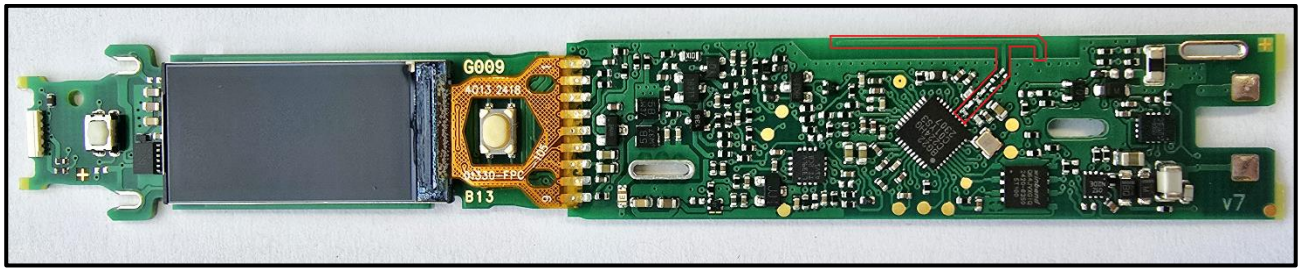


Photo 2

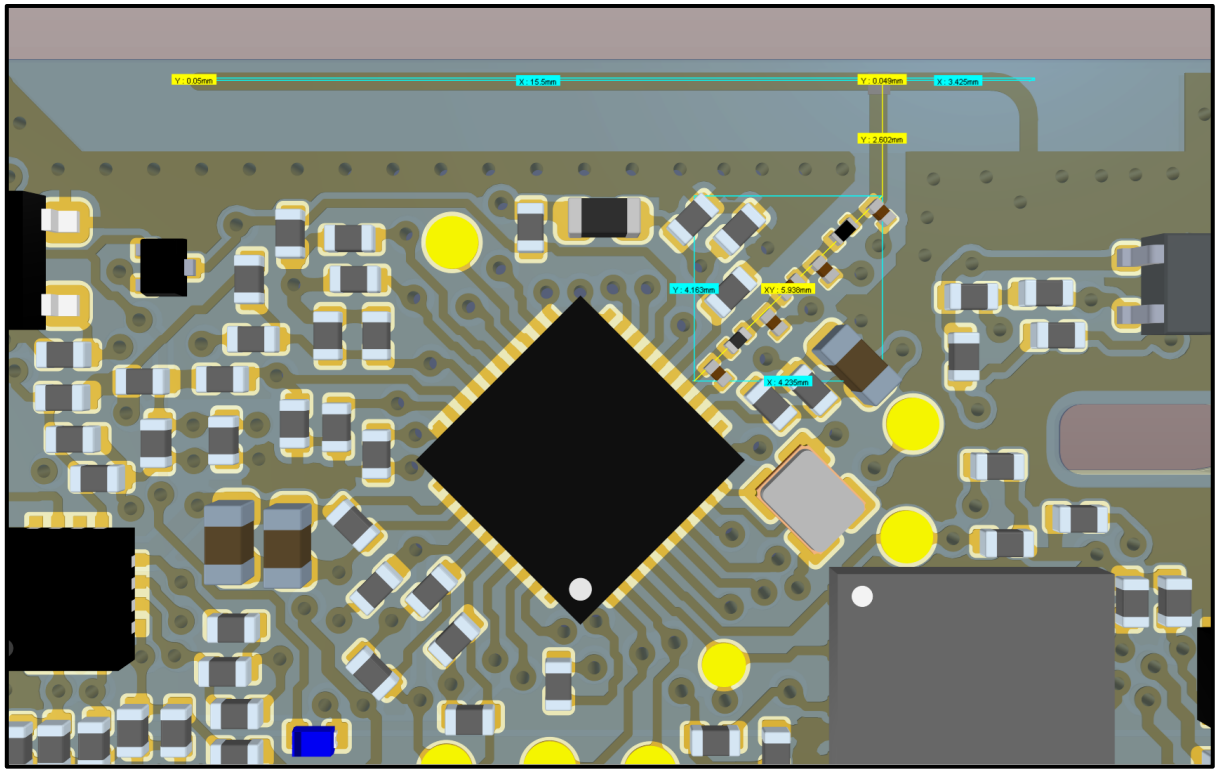

Y : 0.05mm
X : 15.5mm
Y : 0.049mm
X : 3.425mm
Y : 2.602mm
Y : 4.163mm
XY : 5.939mm
X : 4.235mm

Photo 3

9. Report Revision History

Version Number	Revision Details		
	Page No(s)	**Clause**	**Details**
1.0	-	-	Initial Version
Test Report Version 1.1 supersede Version 1.0 with immediate effect Test Report No. UL-RPT-RP-15478060-116B Version 1.1, Issue Date 14 November 2024 replaces Test Report No. UL-RPT-RP-15478060-116B Version 1.0, Issue Date 11 November 2024, which is no longer valid.			
	Page No(s)	**Clause**	**Details**
1.1	8	3.4	Antenna gain table updated
	25	7	Equipment list updated

--- END OF REPORT ---